SPECIAL COMPARATIVE REPORTS.

Summit.—The following table shows depth of snow on ground at Summit on several dates in April for a number of years:

	Apr. 1.	Apr. 15.	Apr. 30.
	Inches.	*Inches.*	*Inches.*
1907	240	165	117
1908	50	31	23
1909	188	158	129
1910	65	32	12
1911	135	146	96
1912	50	30	29

SUNSHINE.

The following table gives the total hours of sunshine and percentages of possible:

Stations.	Hours.	Per cent of possible.	Stations.	Hours.	Per cent of possible.
Eureka	141	35	Sacramento	222	56
Fresno	304	77	San Diego	238	61
Los Angeles	250	64	San Francisco	192	49
Mount Tamalpais	206	52	San Jose	240	61
Red Bluff	189	48	San Luis Obispo	214	55

There was less sunshine during the current April than during April last year.

NOTES ON THE RIVERS OF THE SACRAMENTO AND LOWER SAN JOAQUIN WATERSHEDS DURING APRIL, 1912.

By N. R. TAYLOR, Local Forecaster.

Sacramento watershed.—For the fifth consecutive month the rivers of the Sacramento drainage basin have been exceptionally low. Previous low-water records for the month were broken at all points, except at Red Bluff on the Sacramento, where the river averaged 0.4 of a foot above the low water of 1908. At Colusa, Knights Landing, and Sacramento City the Sacramento averaged from 7 to nearly 10 feet below the stages usually maintained during the month in question.

In the Feather, Yuba, and American watersheds all streams averaged the lowest on record for April.

The rainfall throughout the Sacramento Valley was deficient generally, and the amount which fell had little effect on stream flow. The greatest rise reported was at Colusa, where the river rose slightly over 3 feet during the 24 hours ending at 7 a. m. of the 12th.

Lower San Joaquin watershed.—While less than the normal amount of rain fell in this watershed, the shortage was not so marked in the higher regions as in the floor of the valley. The effect of rainfall on stream flow, however, was barely apparent in any of the rivers, all of which averaged lower than for any corresponding month of which there is a record. The San Joaquin itself, from Lathrop to the mouth of the Calaveras, averaged over 10 feet below the mean stage of the past 13 years, and was over 6 feet below the previous low-water stage for April.

NOTES ON THE RIVERS OF THE UPPER SAN JOAQUIN WATERSHED.

By W. E. BONNETT, Local Forecaster.

The stages of the streams of the Upper San Joaquin watershed continued to be extremely low during April. They were much lower than the lowest previous stages for this month in the six years of record. At Merced Falls, on the Merced River, the mean stage was 0.9 foot, as compared with a mean stage of 1.7 feet for the last six Aprils. Following some good rains on the 9th, 10th, and 11th the river at this point rose to 1.5 feet, the maximum stage of the month.

Similar conditions obtained on the San Joaquin. The mean stage at Friant was but 0.3 foot and at Firebaugh −0.4, as compared with six-year averages of 2.4 feet and 5.2 feet for these stations, respectively. The highest stage at Friant occurred on the 11th and at Firebaugh on the 13th and 14th.

At Piedra, on the Kings River, and at Three Rivers, on the Kaweah, the highest stages for the month also occurred on the 11th, but they were only a few tenths of a foot higher than the low stages which immediately preceded that date. The stages in these streams were low and remarkably uniform throughout the month.

From the irrigators' viewpoint the streams have been disappointingly low. Several canals, particularly those served from the Kings River, which by judicial decision are not entitled to water until the stream has reached a certain stage, so far this season have been without water because the stream has not risen above the required stage.

NEW HEATER AND VAPORIZER FOR FROST PROTECTION.

(Advance copy printed in Pacific Rural Press, Apr. 27, 1912.)

By Prof. A. G. MCADIE, U. S. Weather Bureau.

Various types of heaters and smudgers were described in Bulletin No. 29, United States Weather Bureau, entitled, "Frost Fighting," issued March 13, 1900.

The first heater used, so far as our knowledge goes, was the wire basket coal burner of Copley, at Riverside, Cal., in the winter of 1895–96. The first oil burner was used in California in the winter of 1900–1901. Since then many burners and orchard heaters have been devised, and there are now on the market 17 or more types of orchard heaters, most of them oil burners.

There has naturally been competition among the makers, and claims of superiority are published and widely distributed in fruit-growing States. It may be said that nearly all of the heaters are serviceable and that there is no longer any doubt concerning their protective value. The problem now is one of higher efficiency, together with cleanliness of method and ease of handling. There are two ways in which improvements can be made, one by securing a more uniform and more complete combustion, and the other (closely connected) by decreasing the amount of soot. Crude oil is unquestionably the cheapest fuel where combustion methods are used, although we believe covers are most economical in the long run. Tests by Lewis and Brown, in 1910, and by O'Gara, in 1911, show that crude oil is best per unit of cost; but the method is not a clean one, and if the orchards are located in a thickly settled community, as is the case with the orange groves of California, vigorous objection is made to the soot. Moreover, greater uniformity in the rate of combustion is desirable. With many of the present types of orchard heaters, especially the open-pail variety, the rate of combustion decreases with the time of burning. Soot arresters do not help, but rather make matters worse; and there is constant complaint that after burning a few hours the amount of heat given off is much diminished, and this at a time when heat is most needed.

With a view to meeting the above objections, two new methods are being tried at the local office of the Weather